



JANUARY 1987

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ZERO BEAT is published monthly in the interest of the members of the Pikes Peak Radio Amateur Association, Inc., P.O. Box 16521, Colorado Springs, Colorado 80935. Cost is 50¢ per month for non-members or a \$4.00 per year subscription. Permission is given to reprint articles or excerpts provided credit is given. Deadline for submission of articles is the 21st of the month. Classifieds accepted anytime.

The Pikes Peak Radio Amateur Association meets on the second Wednesday of each month at Giuseppe's Depot Restaurant at 10 S. Sierra Madre at 7:30 p.m. All amateurs and interested parties are invited to attend.

Editor: Phil Somers VE1ARC, 1075 Allegheny Dr. Colorado Springs, CO 80919 590-7136

HOW TO REPLACE A DIAL LIGHT by Phil VE1ARC

One of the most dreaded failures in amateur radio equipment is the loss of a dial light. To my horror, I discovered that my Kenwood TR7930 2-meter rig had suffered such a loss, and of all times, during the Christmas holidays. The ensuing struggle brought back many memories of previous battles. A summary of dial light problems could be a sub-category of Murphy's Laws.

First of all, a burned out dial light is usually just one of two or more, so there is no real critical emergency. But have you ever seen a ham who could sit still and look at a partially-lit dial. As well, he usually knows that he can't fix it anyway because he has no replacement bulbs. However, the temptation is to great so he gets a screw driver and begins to take the case apart.

Have you noticed that these new miniature rigs have a secret combination to get into the case? The immediate hope is that the dial itself may come off. No such luck! Well, you know that the knobs must come off. That is always a pleasant job. There is a fine line between the amount of force required to remove a knob, and the amount required to bust it. You try a little, then a little more and then a whole bunch. About this point, the thought occurs that there may be something else holding the thing on. But after a lot of looking from all angles, everything points to a simple push-on knob. With teeth clenched, you pry the thing off.

OK, that was the volume control. The squelch usually works the same. Now for the large frequency selector knob. It should have a couple of set screws. You get your little plastic case of Radio Shack screwdrivers. But the clever Japanese designer has used a clever little Allen screw. Where are your Allen wrenches? Nowhere to be found, especially not the ones that are that small. What about the screwdrivers? Would one of them work? Yes! Well, sort of. It took the screw out, and took the corners off the screw, and the corners off the screwdriver, and part of the plastic knob. That was the first of two set screws in that knob. The second is stuck. It takes much finesse with pliers, a large screwdriver to pry, and the rest of the edges on the little screwdriver to get that one out.

Now the thought occurs. Is it really worth this struggle to get to that faulty light? Not really, but I can't stop now. The front face of the case won't come off unless the top and bottom panels are removed first, and vice versa. Time to consult the manual in hopes that there is some clue. There is! It says: "Open the case". Maybe if you get a flat screwdriver and pry up one corner, you can see what is holding the thing together. You finally end up prying the thing apart to discover the way it should have been done. I'll bet some guy has a patent on that ingenious little puzzle.

(continued on page 9)

"VIEW FROM THE PEAK"

by George Hinds, NSCIX/Ø

FROM "HIGH BALL" TO "HIGH TECH" -

HOW RAILROADS "KEEP 'EM ROLLING"

- Part Two -

In this concluding installment about railroading and traffic control through electronics, we'll "go modern" and leave the days of Morse code and steam engines behind.

Whereas in earlier days the office of a train dispatcher was simple: telegraph and/or telephone, a "train order book" in which to record orders issued, and a large "train sheet" upon which to register the location of trains upon the division or district under his jurisdiction as the hours passed, today sees the train dispatcher in a new environment. As the computer comes in, handwriting of orders, etc., goes out.

"Computer" train dispatching now is taking over: computers are programmed with all the physical characteristics of the trackage involved; as each train and the details about it (priority, length, planned departure and arrival times, and anticipated speed) are entered into the computer, it plans for the operation of that train over the rails and where it may need to stop or most advantageously meet or pass trains. The dispatcher then can activate the program which sets the signals and switches accordingly. At any time the program can be overridden by the dispatcher should the need arise.

Where CTC (Centralized Traffic Control) is in use, a large track diagram board will be located in front of the dispatcher ("DS" in railroad Morse code lingo) upon which the position of track switches, signals and train location will be shown. Simply by pushing buttons near the associated signals and switches shown, he can stop, start or route trains as desired. At hand are his (or hers) multi-channel radio for direct communication to train and maintenance personnel. All of this is recorded for

reference by multi-channel recorders.

Displays are changing as TV screens replace panel boards. In fact, a new dispatching office in Portland, Oregon, for the Union Pacific has the appearance of a "Starship Enterprise" and is sometimes referred to as the "Star Wars" room by the train dispatchers there.

A panoramic control board displaying trackage over more than 3500 miles of UP lines in the Northwest is projected on a screen 8' high by 80' long! Computers generate the track, train, signal and switch information, which is shown through a bank of "big screen" TV projectors to the screen. Six dispatchers (one for each railroad district covered) are seated so as to watch the display; in addition, each has a color monitor at his position displaying his particular territory for "close-up" details.

Radio blossomed with the advent of remote base and repeater operation, plus microwave relay systems. But radio as in use today is being supplemented by new technology: satellites, transponders and computers. Even now, train control via satellite is being tested using a Department of Defense Navstar positioning system on a line of the Burlington Northern. On the Union Pacific, a system using transponders and interrogators is to be under test in the North Platte area.

The satellite-using technique will indicate the position of a train within 150 feet, and train speed plus or minus one m.p.h. It is not reliable (yet) in showing which track a train is on where tracks are side by side, nor in affording complete coverage in mountainous country (it has some "black-out" caused by the terrain and "line-of-sight" restrictions. However, with some refinement, this deficiency will be overcome.

Meanwhile, less costly means for more direct, cost-efficient control of trains are being adopted very rapidly through the growing use of vastly improved, more reliable, train radio (most of which uses FM from 160.215 - 161.565) and by the elimination of rules once necessary for earlier forms of control.

Train orders now are often issued

directly to the train crew instead of to an operator for delivery to the crew. Conductors and enginemen carry the required blanks which, when filled out as directed by the dispatcher via radio, provide the authority for the movement of the train over the territory involved. Clearly, this is a saving in labor costs through the virtual elimination of an entire craft: telegraphers/operators.

While railroads are venturing into "Advanced Train Control Systems" and the use of satellites, computers and also voice/packet radio, this technology is not confined to office use, nor to train dispatching: while on a Canadian National Railways locomotive recently, I was shown the on-board "micro" that controls many functions and also keeps a running record for ONE YEAR of mileage, speed, amperage, throttle position, trouble alarms, etc., as in service on this newest of General Motors 3800 h.p. diesel locomotives.

Electronics are spreading rapidly, too, in the field of trouble detecting for moving trains - "hot box" detectors are located along main lines and warn the train crew and the dispatcher when such overheated axles occur, often by voice over the radio. So, too, are warnings given in the event of dragging equipment under cars or locomotives. Here, in the Rockies of Colorado, where main lines are often located in deep canyons and along rivers subject to flash floods and rocks falling upon the track, alarms of such an occurrence are sometimes given over train radios as well as by placing nearby signals at the "stop" position. Solar power is widely used at remote locations, too.

Oh, yes - in conclusion, I must report that no longer does the crew always have to carry a jug of coffee to work; in the cab of this newest Canadian locomotive is an electric coffee/tea maker along with other necessary creature comforts. After 42 years, while seated in that big engine, I wondered: did I leave railroading too soon - yet, on the other hand, with the removal of my little red caboose, perhaps both I and the caboose have earned a well-deserved rest. Well, in any event, hope you all have a happy, healthy, safe and prosperous 1987! 73,

George N8CIX/Ø

HAM LICENSING

VE Program, Colorado Springs

VE testing for the purpose of obtaining or upgrading an Amateur Radio Station /operator license, sponsored by the Pikes Peak Radio Amateur Association, will be conducted on 14 February 1987 at the First United Methodist Church located at 420 N. Nevada Ave., Colorado Springs, starting at 9:00 A.M. PRE-REGISTERED applicants and WALK-INS are welcomed.

Instructions:

- A. PRE-REGISTERED Applicants must mail:
1. Completed current FCC form 610.
 2. Photocopy of current license.
 3. A check or money order for \$4.25 payable to ARRL/VEC.
 4. The above must reach the volunteer examiner team contact by 9 Feb 1987.

Send application to our team contact:

MAX STAFFORD - KDØEL
6580 Snowbird,
Colorado Springs, CO 80918

- B. WALK-INS must bring to test sites:
1. If currently licenced, your current licence.
 2. A photocopy of your current license.
 3. A check or money order for \$4.25 payable to ARRL/VEC.

NOTE: All applicants will be required to provide photo proof of identification at time of examination.

Handicapped applicants should notify the team contact immediately so that appropriate procedures can be coordinated.

For further information, please contact Ron Deutsch NKØP 593-8352.

Membership in PPRAA or the ARRL is not a requirement for taking the above test.

Talk-in will be on the 146.37/97 repeater.

VHF & ABOVE NEWS by NKOP

It's time for the annual ARRL January VHF contest again. Contest starts 1900 UTC Saturday January 10th and ends 0400 UTC Monday January 12th (see DEC QST pg 79)

This year we are going to enter a club category as well as individual scores. Our club score will be based on the total scores of all club participants. To give the club points contact any of the club stations on the following frequencies: 50.110 USB, 144.20 USB, 146.55 FM, 220.1 USB, 220 FM (freq to be announced), 432.10 USB, 446.0 FM, 1296.1 USB.

We cannot use 146.52 or any repeater frequencies! So far the stations on will be NKOP, N0CMW, WA9ABB, NL700 and hopefully many more!!

This is a super time to test the capabilities of your station. There will be stations on in Wyoming, Kansas, Nebraska, New Mexico, Texas, and Oklahoma, as well as many grids in Colorado. Many of these stations are workable with modest power levels on CW. Most will also be on SSB. The past two years I have worked over 100 stations on 2 meters so dust off that 2 meter all mode and give it a try!

The popular VUCC award has been expanded to include 24 and 47 GHz only 5 grids are needed to qualify. With the availability of Pikes Peak in the summer its possible we may see one of the first awards here! The first 5 qualifiers receive a walnut plaque from ARRL.

The Front Range Microwave Society is planning a meeting in Denver in mid January. If you are interested in going please contact me for details.

There is an excellent follow-up article in Jan 73 magazine on 10 GHz operation on a budget. Some refinements to the circuit as well as a source of Gunn diodes. I am currently awaiting a letter from a possible source of 10.250 DROs if you are interested let me know.

Thats about it for this month. Hope to here you during the January Sweepstakes!! 73s Ron NKOP

Notes VHF Contest Times in MST.
Start: Saturday, 10 Jan - 12 noon
End: Sunday, 11 Jan - 9 PM

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JANUARY MEETING

The next regularly scheduled meeting of the Pikes Peak Radio Amateur Association will be held on Wednesday, January 14 at 7:30 PM at Giuseppe's Depot at 810 S. Sierra St. The program will feature HomeBrew Night by some of the best homebrewers in the Pikes Peak region. Got a recent project you are proud of? Bring it along and win \$20, \$10, or \$5.

SMOKING

It would be very much appreciated if those smokers who are able could limit their smoking during the General Meetings. The air conditioning is very poor in the meeting room. Some people are so affected that they may not be able to continue to attend in a very smoky room. Thanks.



Invisible antennas do not give the appearance of being an antenna but they exhibit the same traits as all antennas do when it comes to feeding them. They may be resonant or not, they may have a high impedance or low, and they obey the same laws of physics that all antennas do.

For the most part, they are electrically small, because ham-band high frequency waves are usually bigger than the structures used to hide antennas. Consequently it will be most profitable to focus this month's discussion on electrically small antennas. Bear in mind that some of what is said may be irrelevant or wrong for the occasional invisible antenna which is fortunate enough to be comparable in size to the wave it is expected to radiate.

The two fundamental types of antennas are dipoles and loops. Either may be used as an invisible antenna with the choice between the two best decided by physical factors such as the layout of the structure housing the antenna and the presence of conductors (AC lines or telephone lines, for example) that you might have to avoid. It seems pretty evident as to which type of antenna is which. Yet there are some puzzlers. Consider a folded dipole-which is it?

For small antennas, the answer is determined by the DC characteristics of the antenna. In other words, put a VOM on it! Loops will look like a short while dipoles will look like an open circuit. That folded dipole, if it is electrically small, behaves like a loop antenna!

The importance of this is the following: small loop antennas look like small resistances in series with inductance and small dipoles look like small resistances in series with capacitance. This will have a major impact on which types of antenna tuners will load the antenna.

A small dipole will load up with a matching network consisting of a series inductor (on the antenna side) and a shunt inductor (on the transmitter end of the shunt inductor). A small loop will load up

with a series capacitor (antenna side) and a shunt capacitor (transmitter side). Other, more complex circuits will also work, however, the networks I have mentioned give the minimum Q -- good for increasing the bandwidth of the tuned antenna and not so good for reducing harmonics.

By the way, I have assumed that the transmission line, if any, is short. When I worked 73m on an indoor dipole, my antenna lead terminated in a banana plug that plugged right into my tuner. If you need, say, 60 feet of coax to connect your rig to your indoor antenna, your shack is a lot bigger than mine!

How much inductance or capacitance is required? That is sort of like asking "how do I get to Pikes Peak from here?" The answer depends on where you are, and even then there are many possible answers. You may take a circuitous route or the most direct route. The most direct route, in the electrical sense, provides the lowest Q. This is important because increasing the Q of either the matching network or the antenna raises the voltages and currents involved. Depending on the Q and the power level you run, you might just find yourself operating B1 emission (spark gap)! Naturally, the FCC would take a dim view of that.

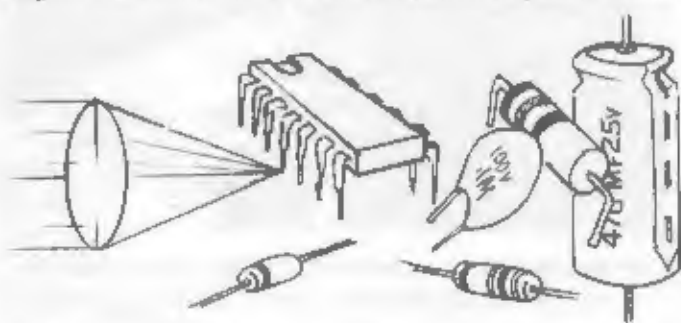
The antenna Q and the matching circuit Q must both be considered. If you are using a small loop antenna, the currents in it will increase with the antenna Q. You might want to make some estimates and be sure that the wire size you employ will not overheat. For a small dipole, the voltage on the elements will increase with increasing antenna Q. You must insure that you have adequate insulation on your antenna wire, and you must consider the ends of the dipole. If they are too "pointy" they can "go into corona" -- see "B1 emission, above." Ham ingenuity can help here. You might solder a brass washer or a fishing sinker to the wire ends to reduce their "pointiness."

Wither to go now? I might wring another column or two out of this topic, or we could change directions altogether. Reader feedback please!

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Q-Beat Interview with Jim - WA9ABB
conducted via Packet Radio.

Q-Beat: When and where were you first licensed?

WA9ABB: I was first licensed as a novice (WN9ABB) in June of 1961. I was living on O'Hare Field in Chicago, Ill. I was 16 years old and in the 11th grade of high school.

Q-Beat: Do you remember your first rig?

WA9ABB: My first rig was a used Heath DX-20. The receiver as a Lafayette radio kit with about six or seven tubes in it. It was state of the art in about 1945.

Q-Beat: What did you use for an antenna?

WA9ABB: It was a 40 meter dipole only 8 or 10 feet above the ground. We lived in a mobile home park and it was not even above the roof of the mobile home. Results were dismal to say the least.

Q-Beat: How did you study for your licence? With a club?

WA9ABB: I had become interested in electronics at about age 13, but it was not until I attended high school at Des Plaines, Ill. that I learned anything about ham radio. The school had a radio club and I learned code and theory there plus used the ARRL license manual. I did not have a code oscillator so I went around saying dah di dah dit in public as I practiced. The people around me must have thought I was nuts... some still do!

Q-Beat: Do you remember your first contact? What band? Did you get a QSL?

WA9ABB: My first QSO was on 40 meters with a ham in Niles, Ill. during the day time. I cannot remember his call and did not get a QSL from him. I was so nervous the first QSO that I forgot everything. It was a real disaster. (I wasn't that nervous the first time I had sex hi!).



Jim, WA9ABB displays just some of the nice gear in his well-equipped shack.

Q-Beat: What has been your best DX on HF?

WA9ABB: Well I have never been a real DX chaser. I prefer a good old fashioned rag chew. I have worked some DX on RTTY and CW. My first real DX station was on 20 meters shortly after I upgraded to Conditional class license. I worked a South African station with my old DX-20 and the dipole. The South African station was on phone and I called him on CW and we had a short QSO. Never got a QSL from him though.

Ø-Beats: What has been your best VHF/UHF contact?

WA9ABB: Well I have worked several stations out in Kansas on two meter SSB. I play around on VHF a little, but I am not a real serious VHF nut like quite a few of the others in Colorado Springs.

Ø-Beats: What is your most memorable, or interesting, or strange, or whatever, story connected with amateur radio?

WA9ABB: Well I can't think of any tall tales right now. But nothing that hams do really surprises me.

Ø-Beats: What are your current amateur radio interests/modes, etc?

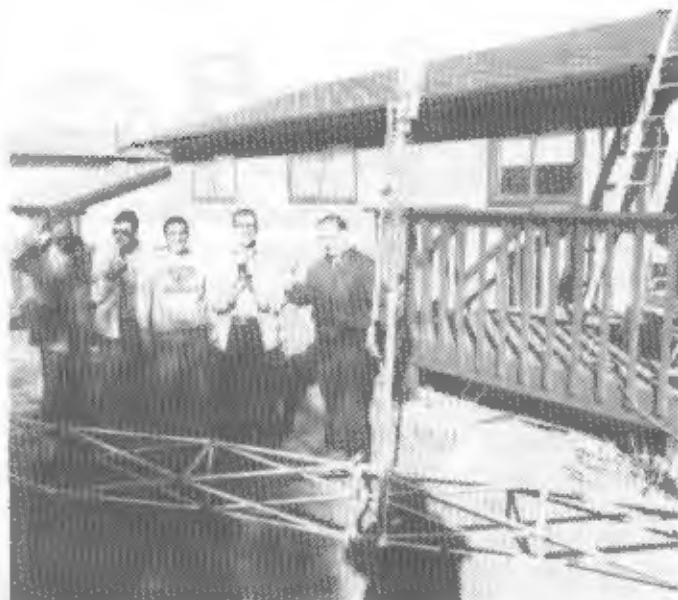
WA9ABB: I think if I had to give up everything else, I would still love CW operation on 40 and 80 meters. But I also enjoy RTTY, AMTOR, and packet radio. In the early years, I had plenty of time, but no money or equipment worth a darn. Now I have more money and equipment, but no time. Hopefully the day will come when I have time and equipment and can really enjoy the hobby. Ham radio is more than a hobby to me. It is a way of life.

Ø-Beats: What is your license class and what are your thoughts on CW?

WA9ABB: I have an extra class license. I love CW, but realize that is probably a minority position these days. It is a challenge. Anybody can pick up a microphone or a RTTY keyboard, but it takes a real skill and perseverance to be a good CW operator. I would like, however, to see the 13 wpm code requirement dropped to 10 wpm for general class hams. I know so many hams who, try as they may, just can't seem to get above 10 wpm. I think it is unfair to this group of hams to keep them from being able to upgrade and enjoy the HF bands.

Ø-Beats: What gear do you have in your shack? What antennas?

WA9ABB: On HF, I use a Yaesu 757 and FC102 antenna tuner. The antenna is an inverted vee cut for 80 meters, but with a couple of 40 meter traps. I also have a Heath SB200 linear, but have not used it for months. Loaned it to a friend and let him rewire it for 220v, and I have not



Jim, WA9ABB (center) tries to organize a slightly confused tower raising party.

rewired it for 110v or put a 220 line to the shack yet. On two meters, I have several FM rigs. One is the Kenwood TR751A all mode that I use on SSB. Another is the Kenwood TR7950 which is used full time on packet radio. I have a old Heath two meter rig for FM (52 simplex). There is a Santec two meter handitalkie. In the car, I run an Icom 27A two meter FM rig. My latest rig is a KDK 740 440mhz FM rig. As I said, now I have plenty of toys, but not enough time to use them all.

Ø-Beats: What do you hope to accomplish/enjoy in amateur radio in 1987?

WA9ABB: I really enjoy working with the kids at the Deaf and Blind School. I hope that I can get several more of them licensed and hope to get the new novices there upgraded to technician or general. It is a very slow process with them, and may take till 1988, but we'll keep at it. I also hope that our club's Swapfest will be as good or better than in 1986.

Ø-Beats: That's all the questions. Do you have anything to add?

WA9ABB: I hope that all of our members have a great year in 1987 and wish the all good health. I would encourage all of them to do all they can to promote our hobby and to try to get the teenagers and young kids into the hobby before we all go the way of the dinosaur.

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How To Replace A Dial Light
(continued from page 2)

Oh no! Look at all those tiny, fragile, critical, untouchable, (did I say fragile?) little parts crammed into this case. How will I ever manage to get at the dial light without doing irreparable damage? Too late now. I am committed. Gently turn the thing over. The bottom is worse. This thing really shouldn't be out of its case like this.

Now lets look at the front panel to see how to get to the lights. There is one light that is setting up on top and very accessible. It probably has an average life expectancy of 5000 years. It is the

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two that have been hidden so cleverly that have a mean life of "warranty plus one week". To get even close to them, you have to remove the circuit board they are on. But you can't get a screwdriver in at that angle. And there are 6 screws holding that 0.01 ounce board. The pliers are called into play once again, but I'm sure the designer of that thin and fragile LCD glass plate never meant pliers to be near it. With more good luck than good management, the board is removed, but there are several more layers before the bulbs. Each is carefully removed. Try to remember the order they go in.

Now there is just the plastic shade over the bulbs. The integral molded plastic shade! A sharp knife does no serious damage that a bit of glue won't fix on the way out. Voila! two little bitty bulbs, the size of LEDs. Bulbs have a mean-time-between-failure of 0.0000001 that of LEDs. But they are real bulbs, soldered in, of course. Well I certainly don't have a replacement like that. There probably were only two of these made for every rig they are in, and the production line has long since closed. But the bad one has to come out none the less.

Oh, I don't believe it! Which is the bad one? I can't remember which part of the dial was dark. Maybe I can measure some resistance on an ohmmeter. As close as I can tell, they both measure 0.00001 ohms. Well, there is only one alternative. Power up the rig. With the case off and everything hanging out???? Yes, it must be done. So you get some pieces of paper and some other non-conducting props, and try to separate all the parts that might touch something and fry the daylights out of all those little fragile components. All set. Turn on the power. Great, no sparks or smoke. Look, even the little LCD glass plate has its numbers on it. And yes, one bulb is not working. That proves Murphy missed this situation, or both bulbs would be working properly. Power off. Now the soldering gun (woops, I mean pencil). I have to use my 25 watt "pencil" on this 0.1 watt bulb soldered to a 0.01 watt trace. Somehow, the deed is done, and I am holding this tiny despicable little bulb.

Somehow, the whole thing went back together with only two screws extra. I'll probably find where they go the next time I take this thing apart to put in the new

bulb, if there really is such a thing. It suddenly occurs to me that if I check the manual or schematic, it may list a part number for this bulb. If so, I didn't need to take the thing apart until I had ordered and received a new bulb. Fortunately for my sanity, there was no such part number. Anyway, I wouldn't have wanted to miss the drama.

So the next time you stare in horror at a missing dial light, don't despair. It may not be urgent. It may not be really necessary. But it is part of ham radio. So try to get that offending light out of there as quickly as possible. Who knows, you may even find a replacement somewhere.

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MINUTES OF THE DECEMBER GENERAL MEETING submitted by Al NØCMW, secretary

There was no general meeting in December. Approximately 33 members and guests enjoyed a nice evening at the Iron Springs Chateau dinner theater, with a nice meal and a very nice show. About 8 diehards stayed and danced till they closed the place.

MINUTES OF THE DECEMBER BOARD MEETING submitted by Al NØCMW, secretary

The Board meeting was held on 15 Dec 1986 at the QTH of Al NØCMW, at 7pm with following present: Ron NKØP, Jim WA9ABB, Al NØCMW, Chris WBØDHU, Don KEØBJ and Bud NØDDF. A letter of resignation as Vice President was received from Don Ross NL7CO due to military commitments. It was accepted with thanks to Don for the outstanding job done so far. An election will be held at the general meeting on 14 Jan 1987 to fill the vacancy. Ron NKØP was nominated by the Board to fill the position of Vice President. Nominations from the floor will be accepted. If Ron is elected, the Board made a recommendation of Nick KØ5N for Ron's vacant Board seat.

We received the new insurance policy for the club liability insurance but so far have not received the bill.

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TAB BOOKS

Rick WB7THT won the 2-meter HT at the Christmas party. Ron says he will have quite a few good prizes at the January meeting. Don't forget that it is home brew night. The club will take part in the January VHF ARRL contest. For info contact Ron NKØP.

We have had a request to support a ski race in January. If they call back, the secretary was told to refer them to the Mountain Amateur Radio Assoc. because it is too late for us to get a group together. There are no messages at the senior citizen club to be sent at this time.

Jim WA9ABB reported the new Club generator has been purchased. It has been serviced and is stored at Jim's house. Our raffle application came back for more info which Jim WA9ABB will enclose and resubmit. We can't do anything with the State on the first try. The Board decided to have an Icom 735 as the main raffle prize at the May 16th Hamfest. Bud and Chris are working on changing our bank account to a more cooperative bank.

The next board meeting will be 19 Jan 1987 at the home of Don KEØBJ. There being no further business, the meeting was adjourned at 9 pm.

NOVEMBER PRIZE WINNER OF \$50 GIFT CERTIFICATE

Buck WD0GSK NEXT DRAWING SATURDAY DEC. 27



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PS 430 Power Supply \$154 - PS 30 \$144
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Icom 745 \$885 Icom 735A \$1395, Free CW filter (\$108 value) with purchase of either
New Yaesu 767GX goes everywhere does everything \$1550
Yaesu FT 757GX \$825, FC 757AT \$265 - 2 only
Kenwood TW4000A 2m & 440 EM Xcvr. Sale \$495
Kenwood TR 3600 440-MHz HT w/free extra battery \$319
Kenwood TR 2600A new HT w/extra battery Sale \$265 closeout
New Kenwood TR 251A 2 meter all mode w/GaFet preamp \$525
Kenwood TH31BT \$325 TH41BT \$235 TH303AT \$228
Kenwood TH21AT \$198 TH31AT & TH41AT \$190 each - both with free extra battery
Kenwood TM 2570A 70 watt 2 meter FM mobile \$439
Kenwood TM 2550A 45 watt 2 meter FM mobile \$359
Kenwood TM 2530A 25 watt 2 meter FM mobile \$325
Kenwood 211A \$300 (1 only)
Santec 20T w/2 number memory dialer \$250
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New Icom 28A-132-174 MHz scan/receive 25W \$359
New Icom 28H-same spec as Icom 28A w/45W \$379
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Icom 2AT HT \$238
Icom 02AT \$328
Icom 4AT \$293
Icom 04AT \$375
Icom 27A w/TTM \$349/Icom 27H w/TTM \$379
Icom 47A \$439
Icom 3200A 2 meter/440 dual bander \$495
Daiwa Meters, Switches & Rotors - in Stock - The Daiwa color is great!!
Mirage Amps - Low Prices - in Stock
New KDK FM 240 mini 25W w/TTM & LCD display, encoder/decoder TO 156 MHz receive \$320 w/o tone \$290
Yaesu FT 209RH 5 watt FM HT \$275
Yaesu FT 2700RH 2 m-70 cm dual bander full duplex \$479 (2 only)
Yaesu FT 227R 2/70cm HT - New CPU \$415
Yaesu FT 23R 2 Meter HT w/TT Pad \$265
Yaesu FT 73R 70 cm HT w/TT Pad \$278
Ten Tec Corsair II HF Xcvr. \$1149
Ten Tec Century 22 HF CW Xcvr. \$349
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Astron PS - ALL AMPS - Low Prices - Astron RS 50 and V50 in Stock
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AEA PK 232 data controller internal HT/VHF modem \$305
AEA CP-1 Computer interface \$178

AEA PK64A w/HFM & long cord \$355
AEA PK 64A w/o HFM \$255
AEA PK 64 packet/sw 11ty etc. controller \$300 - HFM \$95
AEA PK 64 system w/ HFM 64 installed \$210
Kantronics KPC 1 level 2 - special sale \$135 - 2 only
Kantronics Packet Program-includes program for LTL
Kantronics LTL XT/P now includes Packet for HF
Kantronics KPC 2 Packet Controller version 2 w/HFM \$165
Kantronics Hamster Hamsoft VIC 20/64 \$75
Kantronics KAM all mode controller-
CW/RTTY/ASCII/AMTOR & Packet \$275 HF & VHF Packet
MFJ w/er & dry dummy loads - in stock
MFJ Tuners and Keyers - in stock
MFJ 989 roller inductor tuner \$289
MFJ 962 1.5 KW tuner-160 to 10 meters \$279
MFJ 980 3 KW tuner \$175
MFJ 1224 interface in stock w/free soft program - Fall Sale-\$75
MFJ 1229 interface w/free soft program - Fall Sale-\$149
MFJ 1270 packet controller (TNC-Z) \$120

USED EQUIPMENT

Kenwood TR 2400 - nice \$135
Kenwood TR 7930 \$275
Kenwood TR 8400 70 cm \$235
Kenwood TS 820 w/CW filter \$435
Kenwood TS 520 \$325 firm
Kenwood ST1 desk power supply/charger for TR 2400 \$35
Kenwood AT 250 auto tuners \$225
Icom 2A w/o TTP \$125
Icom 2AT \$135
Icom 02AT \$250
Icom 02AT w/mod \$275
Icom 27H 45W 2mtr mobile \$295
Icom 751 - minr condition \$775
Conset tube type 588 2 mtr amp - works good, built-in P/S - 5W in 250W out -
can be biased for FM operation - extra tubes available \$150
Azden PCS 300 2 mtr HT-nice \$150
Tempo 54 70 cm HT-very nice \$150
Yaesu FT70BR 70 cm HT \$185
Yaesu 757AT auto tuner \$195
Yaesu FT 101E \$325
Yaesu FT 101B \$275
Yaesu FT100B used, mini \$350
Yaesu FT 757GX - Nice \$695
Yaesu FT 221 - 2 mtr, all mode base/mobile \$275
Yaesu FT 207R - Nice \$175
Drake T4X w/M5A ps/spkr \$175
Drake R4C rcvr \$250
Etec digital readout for Drake C line
Heath HR108 rcvr, HX31 CW rcvr, HG108 VFO all in nice condition
for a novice station \$100 for set
Tokyo High Power 160V 3/10 in 160 out amp w/preamp \$275
Mirage B108 2 meter FM/SSB amp - HT or 10W in/80 out \$525
AEA CP1/64 w/MBA TestPac \$100
For the technician-Yaesu FT980CAT xcvr w/SP980P patch/spkr with P/S removed due to bad power
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